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ABSTRACT

Diagnosis is a cornerstone of clinical practice for mental healthcare providers. Yet traditional diagnostic systems have shortcomings, including inadequate reliability, high co-morbidity, and marked diagnostic heterogeneity. The Hierarchical Taxonomy of Psychopathology (HiTOP) is a data-driven, hierarchically-based alternative to classification that conceptualizes psychopathology as a set of dimensional symptoms organized into increasingly broad, transdiagnostic spectra. Prior work has shown it improves reliability and validity, but translating a model like HiTOP into a workable system that is useful for treatment providers remains a challenge. To this end, the present work outlines the model and its major principles to guide integration of HiTOP into clinical practice. We illustrate what an approach like HiTOP would look like in practice relative to traditional nosology, and review advantages and limits for its clinical utility, including case conceptualization and treatment planning. Finally, we address commonly perceived barriers to its clinical integration.

Keywords: Nosology, Classification, Psychopathology, Diagnosis

Significance: Redefining a taxonomy of psychopathology along empirical grounds results in dimensions, not categories, that can be organized hierarchically—with at least six higher-level spectra near the top of the model and more specific lower-level components and traits at the bottom. This approach fosters integrated case conceptualizations and can align more closely with transdiagnostic treatments, while maintaining flexibility to define more narrow targets for intervention. Case illustration shows how a model

like HiTOP can be used in clinical practice today, although more work is needed to establish it will improve clinical utility.

Integrating the Hierarchical Taxonomy of Psychopathology (HiTOP) into Clinical Practice

A reliable, valid, and clinically useful classification system for mental illness is a cornerstone of clinical practice in the ideal (Kendell & Jablensky, 2003; Krueger et al., 2018; Mullins-Sweatt & Widiger, 2009). It facilitates communication, orients and guides treatment planning, and serves as a common basis for administering care. It also can provide information about the natural course of illness against which to measure the effectiveness of treatment as well as create a foundation for research (APA, 2006; APA, 2013; First et al., 2014). In contemporary mental healthcare systems, diagnosis has overwhelmingly meant using some version of the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM*; APA, 2006) or the *International Statistical Classification of Diseases and Related Health Problems* (*ICD*; WHO, 1992).

However, these nosologies can fall short of ideals (Clark, Watson, & Reynolds, 1995; Krueger et al., 2018). Excessive co-occurrence of disorders (i.e. comorbidity) contributes to doubt regarding their distinctiveness (Clark, Cuthbert, Lewis-Fernández, Narrow, & Reed, 2017). Alternatively, marked within-diagnosis heterogeneity means that individuals with the same diagnosis can have different sets of symptoms (e.g., thousands of unique symptom presentations for a given diagnosis; Galatzer-Levy & Bryant, 2013), so the pathophysiology, clinical course, and treatment of choice for patients with the same diagnostic label may differ dramatically (Hasler, Drevets, Manji, & Charney, 2004; Olbert, Gala, & Tupler, 2014; Shackman & Fox, 2018; Zimmerman, Ellison, Young, Chelminski, & Dalrymple, 2015). Reliability for several diagnostic categories is low (e.g., ~40% of diagnoses examined in the *DSM-5* field trials did not show acceptable inter-rater

agreement; Chmielewski, Clark, Bagby, & Watson, 2015; Regier et al., 2013), although not out of line with estimates for diagnoses from other areas of medicine (Kraemer, Kupfer, Clarke, Narrow, & Regier, 2012). Finally, traditional systems define mental disorders in terms of strictly demarcated categories of mental illness, yet it has been recognized that most psychopathology falls along a continuum with normality, without the sharp break implied by categorical nosologies (e.g., Carragher et al., 2014; Haslam, Holland, & Kuppens, 2012; Kent & Rosanoff, 1910; Markon, Chmielewski, & Miller, 2011; Walton, Ormel, & Krueger, 2011; Wright et al., 2013).

Critically, there are concerns regarding the clinical utility of the *DSM* and *ICD*. Practicing clinicians frequently do not assess diagnostic criteria methodically, often lacking the time or motivation to do so (Beutler & Malik, 2002; Blashfield & Herkov, 1996; Bostic & Rho, 2006; Bruchmüller, Margraf, & Schneider, 2012; Hermes, Sernyak, & Rosenheck, 2013; Mohamed & Rosenheck, 2008; Morey & Benson, 2016; Morey & Ochoa, 1989; Taylor, 2016; Waszczuk et al., 2017; Zimmerman & Galione, 2010), although this concern may not be unique to DSM and ICD but be a problem for any nosology. For many disorders, the most frequently used diagnosis is Other Specified/Unspecified (Not Otherwise Specified in previous editions of the *DSM*; Machado, Machado, Gonçalves, & Hoek, 2007; Verheul & Widiger, 2004), meaning the patient's presentation does not fit any specific category. Moreover, the *DSM* and *ICD* categories provide little diagnosis-specific information to guide treatment decisions (First et al., 2018). Most categories have a wide range of applicable treatments, with many pharmaceutical and psychosocial treatments showing transdiagnostic effects (Barlow, Sauer-Zavala, Carl, Bullis, & Ellard, 2013). Indeed, a driving force for assigning a

patient a *DSM* or *ICD* diagnosis may often be less about clinical care and more about administrative or reimbursement requirements (Braun & Cox, 2005; Eriksen & Kress, 2004; First et al., 2018; Mead, Hohenshil, & Singh, 1997; Welfel, 2010; Zimmerman, Jampala, Sierles, & Taylor, 1993).

Quantitative nosology as an empirically based alternative

Quantitative nosology offers a data-driven alternative to traditional classification of mental illness that can address some of its limitations and foster transdiagnostic conceptualizations of mental illness that may better align with clinical practice. It is focused on identifying empirical constellations of co-occurring signs, symptoms, and maladaptive behaviors, and classifying psychopathology accordingly (Kotov et al., 2017; Krueger et al., 2018). Unlike prevailing nosologies that rely heavily on expert consensus, quantitative nosology seeks an empirically-based solution to classification. Statistical analyses guides the grouping of symptoms into coherent dimensional symptom components and traits, which in turn are grouped into broader dimensions in a hierarchical fashion.

Quantitative approaches to classification have a long history (Blashfield, 1984; Eysenck, 1944; Foulds, 1976; Lorr, Klett, & McNair, 1963; Moore, 1930; Overall & Gorham, 1962; Wittenborn, 1951), especially in childhood psychopathology. Two spectra of mental illness, internalizing and externalizing, are particularly well-established (Achenbach, Ivanova, & Rescorla, 2017), and a third spectrum – thought disorder – has also been identified (Keyes et al., 2013; Kotov et al., 2011a; Kotov et al., 2011b; Markon, 2010). Recent studies involving more varied types and severity of psychopathology have recognized other spectra, including antagonistic and

disinhibited externalizing (i.e., divisions of externalizing), detachment, and somatoform (Kotov et al., 2011b; Markon, 2010).

The Hierarchical Taxonomy of Psychopathology (HiTOP)

In 2015, a new consortium dedicated to advancing the Hierarchical Taxonomy of Psychopathology (HiTOP) was organized by psychologists and psychiatrists with a shared interest in quantitative nosology of mental illness. Its aim is to develop a common nosology based on existing evidence and continuing research with an emphasis on reliability, validity and utility in diagnosis and classification. The resulting model – a work still in progress – is summarized in Figure 1, with a case illustration provided in Box 1.

At the lowest level of the HiTOP hierarchy are symptoms components (tightly-knit groups of symptoms) and maladaptive traits. Each of these is designed to be a homogenous dimension. Examples include performance anxiety and social interaction anxiety.

At the next level of the hierarchy are syndromes - constellations of related symptoms, signs and traits that strongly co-occur. For example, the syndrome of social phobia includes trait submissiveness as well as anxiety about both performance and social interactions. Syndromes do not necessarily map onto *DSM-5* or *ICD-10* disorders, but they form the HiTOP level that most closely correspond to them.

At the next level up of the hierarchy are subfactors, reflecting small clusters of strongly related syndromes. For example, a fear syndrome includes social as well as specific phobia, and also agoraphobia.

Above this are spectra—broad groups of syndromes and subfactors that are distinct from one another yet still related. For instance, distress, fear, eating, and sexual problem subfactors are grouped into an overarching

internalizing spectrum. Higher levels beyond spectra are recognized in HiTOP, up to a general psychopathology factor (*p*) reflecting overall maladaptation (Caspi et al., 2014; Caspi & Moffitt, 2018; Kim & Eaton, 2015; Krueger, 2018; Lahey, Van Hulle, Singh, Waldman, & Rathouz, 2011; Selzam, Coleman, Caspi, Moffitt, & Plomin, 2018; Wade, Fox, Zeanah, & Nelson, 2018).

Principles for integration into clinical practice

HiTOP provides an empirically grounded framework for organizing psychopathology. Already, there is some evidence of enhanced validity and reliability compared to more traditional, categorical systems (Bernardini et al., 2017; Krueger et al., 2018; Kotov et al., 2017). However, the full value of a model like HiTOP can only be realized if it informs and is adopted into clinical practice, a remaining barrier to its utility (Tyrer, 2018). Here, we articulate three major principles to guide integration of HiTOP into practice, as well as their implications and limitations.

Dimensions with ranges of cutoff scores, not categories. In the HiTOP framework, patient psychopathology is no longer described in terms of categorical diagnoses. Rather, psychopathology is conceptualized along dimensions with varying degrees of severity. This dimensional aspect pervades every level of HiTOP, from components and traits through spectra and superspectra. HiTOP explicitly acknowledges the clinical reality that no clear divisions are empirically supported between most mental disorders and normality or, oftentimes, between neighboring disorders (e.g., Clark et al., 2017; Zimmerman et al., 2015). Subsyndromal symptoms are not a shortcoming of the HiTOP nosology, but an inherent feature. Moreover, the

concept of “diagnosis” is not one of ‘present’ versus ‘absent’, but rather a profile that emphasizes the patient’s symptom severity across each component, syndrome and spectrum.

HiTOP’s adoption of a dimensional perspective in no way precludes the use of categories in clinical practice. For example, it is common in medicine to superimpose data-driven categories (e.g., normal, mild, moderate, or severe) on dimensional measures (Kraemer, Noda & O’Hara, 2004), such as blood pressure or cholesterol. A similar approach can be used with HiTOP. The range can be based on a pragmatic assessment of relative costs and benefits. For instance, in primary care settings, a more liberal (inclusive) threshold can be used for identifying patients requiring more detailed follow-up. Conversely, decisions about more intensive or risky treatments can employ a more conservative (exclusive) threshold. Empirical work has begun to delineate such ranges for some measures (Stasik-O’Brien et al., 2019), but much more is needed to cover the full spectrum. Most importantly, HiTOP explicitly acknowledges that ranges are pragmatic and not absolute, recognizing the need for flexibility in clinical decision making. Categorical and dimensional systems can relay equivalent information (Kraemer, Noda & O’Hara, 2004) so long as cut points are not reified, an approach HiTOP explicitly makes clear. Ultimately, cost-benefit ratios balancing treatment resources relative to base rates and potential adverse effects can optimize choice of ranges (Kraemer et al., 2012), which we elaborate and illustrate more below.

As this work progresses, clinicians ready to implement HiTOP now can use the template of intelligence testing as a guide for making clinical decisions. For example, decisions about IQ, a dimensional construct with no clear demarcations, involve pairing statistical criteria with impaired functioning. IQs lower than 1 – 2 standard deviations (SDs) from the mean (i.e., in the 85 – 70 range) commonly serve as the basis for receiving assistance and resources. Similarly, a statistically based criterion for psychopathology dimensions can be paired with ratings of life-functioning or clinical risk (e.g., suicide potential) to guide intervention. Clearly, this approach requires validation, but it is rational starting place from which to proceed.

In practice, this strategy could be partially implemented now. Several existing assessment instruments congruent with HiTOP are readily available to clinicians (see https://psychology.unt.edu/hitop), although no single one covers the full range of the model (see “Barriers” for more on how to address). Almost all measures we list have normative data, which would allow patients’ scores to be converted into standardized T-scores. These scores can then be used as a starting point for clinical decisions (e.g., 60 – 64 being mild, 65 – 69 moderate, 70+ severe). This approach has advantages but also barriers (e.g., time, effort, and financial cost) reviewed more below. For now, we highlight this strategy simply to illustrate that assessment of psychopathology using dimensions is possible now and consistent with other areas of medicine that treat dimensional phenomena.

Hierarchical nature of illness. Classification in HiTOP is organized and conceptualized hierarchically based on empirical evidence. This feature acknowledges that some clinical questions concern narrow forms of psychopathology (e.g., auditory hallucinations in psychotic disorder), whereas others cut across conditions (e.g., elevated neuroticism as a vulnerability to all internalizing disorders; Shackman et al., 2016). HiTOP's hierarchical organization permits a step-wise approach to assessment, beginning with brief screening of higher-order spectra, and then – based on time and need – progressing to more focused assessments in order to characterize the subfactors, syndromes, and symptoms/traits within each spectrum more fully. This enables clinicians to target a specific level for assessment or intervention.

This flexibility may be particularly important as a nosology is used in settings with different resources and needs. For example, in acute settings, where assessment time may be limited and clinical decision-making focused on emergent or urgent care (e.g., suicide risk; mania), providers can limit assessment to the focused set of six higher-level spectra or to the most relevant lower-level ones. Cardinal or prototypic symptoms can indicate which spectra are elevated—analogous, for example, to diagnosing an unspecified mood disorder. Elevations of higher level spectra can guide treatment planning by indicating the need for more in depth assessment of spectra components and traits later, or by signaling cross-cutting processes common to all forms of psychopathology in this domain; alternatively or in

addition, clinicians can focus on the most relevant lower-level components relevant to that setting. In longer-term settings, or with more time, clinicians can cascade down the hierarchy to flesh out more nuanced profiles of all the narrow, lower-order symptoms and traits (e.g. social versus situational phobia of a fear syndrome).

The flexibility afforded by HiTOP's hierarchy, however, naturally raises questions about the optimal level for assessment and intervention. For example, a clinician could decide to intervene at higher levels of the hierarchy, targeting symptoms and processes common to all of the components that constitute a spectrum. The Unified Protocol Transdiagnostic Treatment for Emotional Disorders (Barlow et al., 2017) is one such intervention focused on vulnerability processes (e.g., increased negative affect, cognitive processing biases, behavioral avoidance) that are thought to underpin many symptoms within the internalizing spectrum. Similarly, selective serotonin reuptake inhibitors have been shown to be efficacious for several internalizing conditions (Martinez, Marangell, & Martinez, 2008) and appear to be effective for subfactors of the spectra (i.e., fear, distress and some eating pathology). Efficacy of these transdiagnostic treatments suggests shared mechanisms and processes related to higher-level spectra may be a parsimonious level for assessment and then intervention, but empirical evidence is needed before supporting this hypothesis. Cascading benefit of treatments focused on lower order components (e.g., treating sleep improves broader syndromes; Taylor & Pruiksma, 2014), for example,

means that focusing on specific lower order components may instead prove more clinically useful. In our example, a clinician could instead focus on addressing specific sleep symptoms using medications (e.g., Kuriyama, Honda, & Hayashino, 2014) or psychotherapies (e.g., sleep restriction) with narrow targets of action.

Ultimately, optimal strategy may be to focus first on the spectra, because interventions that are efficacious for such fundamental problems as negative affectivity or social detachment are likely to provide the patient with maximal benefit, and augment this with additional intervention for syndromes or components that are elevated relative to the corresponding spectrum. However, existing arsenal of spectra-level treatments is limited and at present the choice may be pragmatic, depending on options available for elevated dimensions and on therapist's expertise in these options.

One final point related to the HiTOP hierarchy and how it affects clinical practice: HiTOP recognizes the interplay of traits and symptoms (e.g. Klein et al., 2011 Ormel et al., 2013) and ensures that both are considered in treatment. For example, certain treatments are particularly effective in promoting personality change (e.g., Hudson et al., 2015; Robert et al. 2017), which in turn can improve other mental health symptoms (e.g. Conrod et al., 2013; Zinbarg et al., 2008). Alternatively, explication of traits can guide clinicians in matching treatments to patient's personality vulnerabilities, as they have been found to moderate therapeutic process (e.g., traits related to

agreeableness moderate efficacy of behavioral therapy for distress; Kushner et al., 2016; Samuel et al., 2018).

Impairment rated separately. Functional impairment is not tied to each specific syndrome, but instead is rated separately and reflects global impairment (e.g., Range of Impaired Functioning Tool, RIFT; Leon et al., 1999). HiTOP's separate rating of impairment recognizes the practical and psychometrically questionable challenge of disentangling impairment from symptoms (McKnight & Kashdan, 2009; Uestuen & Kennedy, 2009), especially when multiple syndromes are present (Gijsen et al., 2001). Impairment can continue to be used to assist with clinical decision-making (e.g. pairing elevated symptoms with an impairment threshold to determine "caseness"), but this is not a necessary condition of the symptom profile.

The explicit inclusion of an impairment (or distress) requirement in traditional nosology for each diagnosis (i.e., the "clinical significance criterion") reflected an attempt to address concerns over false positives and has been a source of subsequent debate (e.g., Ustuni & Kennedy, 2009; Spitzer & Wakefield, 1999). HiTOP's conceptual shift away from categories to dimensions allows for this problem to be solved in another way: empirical studies can determine symptom ranges that warrant treatment, and validated against a series of criteria, including but not exclusively impairment. From a practical perspective, it will take time for this body of evidence to develop, and will likely vary across populations. Until then and

even after that, clinicians can pair elevated symptom profiles with a global rating of impairment to guide their clinical decisions about the need for care.

Advantages of HiTOP for clinical practice and their limitations

A more valid and reliable classification system means little if clinicians do not use it. Although empirical work is needed to validate them, there are at least three ways in which HiTOP has the potential to improve the *clinical utility* of a nosology compared to categorical diagnostic systems, as well as limits for each (c.f. Reed, 2010).

First, it may improve communication. HiTOP's use of dimensions increases reliability (e.g.,15% increased reliability of dimension over categories in meta-analyses; Markon, Chmielewski, & Miller, 2011), but it can improve communication by more precisely relaying symptom severity (i.e., percentile scores are now provided relative to population norms for elevated dimensions). In contrast, *DSM* and *ICD* provide heterogeneous categories with less precision about severity, particularly milder symptoms, although efforts have been made to include subthreshold symptom information within both systems (Kraemer et al., 2012). HiTOP also provides flexibility to communicate in greater or less detail depending on the level of review, focusing on a relatively small number of elevated spectra or elaborating on specific syndromes, symptoms, or traits as appropriate. The incremental benefit of this may be limited given one could do something similar with traditional systems (e.g. review diagnostic classes as opposed to individual diagnoses). HiTOP's spectra, however, were derived to be less

heterogeneous than diagnostic classes and may be fewer in number (Kotov et al. 2017).

Importantly, surveys of clinicians suggest that practitioners find dimensional diagnosis informative and workable. For example, clinicians surveyed in recent studies rated dimensional descriptions of personality pathology as better for communication purposes than traditional diagnoses, although not always significantly so (Hansen et al. in press; Glover et al., 2012; Morey, Skodol, & Oldham, 2014).

Second, HiTOP may provide clinicians with greater prognostic power (Hasler et al., 2004). For example, relative to categorical diagnoses, dimensional scores generally show superior prediction of clinical outcomes such as chronicity (Kim & Eaton, 2015), functional impairment (Keyes et al., 2013; Morey et al., 2007), and physical health comorbidities (e.g., Eaton et al., 2013). HiTOP constructs also show notable links with significant non-disorder outcomes. For instance, the association of internalizing disorders with suicide appears to be driven primarily by commonalties within the spectrum rather than specific disorders (e.g., Eaton et al., 2013).

Third, HiTOP-based assessments have the potential to better guide clinical decision-making and improve outcomes compared to DSM and ICD (i.e. enhance the treatment utility of assessment; Hayes, Nelson & Jarrett, 1987). This is not a forgone conclusions as DSM and ICD have established utility: (i) existing treatment guidelines are based on these diagnoses, (ii) categorical diagnosis comports with the dichotomous nature of clinical

action, and (iii) existing administrative systems rely on traditional diagnoses. However, this utility has limitations.

(i) Community clinicians frequently do not select treatment according to diagnosis (Baldwin & Kosky, 2007; First et al., 2018; Hermes, Sernyak, & Rosenheck, 2013; Mohamed & Rosenheck, 2008; Taylor, 2016), instead they focus on symptoms and presenting complaints. Recent studies found that decision-making of community clinicians is more aligned with HiTOP description than with traditional diagnoses (Waszczuk et al., 2017; Rodriguez-Seijas et al., 2017; Hopwood et al., 2019). Consequently, HiTOP will provide clinicians with normed systematic tools to support their preferred practices more effectively than informal interviews on which many rely. Importantly, reluctance of clinicians to follow DSM-based practice guidelines may be a rational choice, given shortcomings of traditional diagnoses. Specifically, when predictive power of traditional diagnoses has been compared to dimensional diagnoses, traditional diagnoses were often found to be inferior (Eaton et al., 2013; Hettema et al., 2005; Kaczkurkin et al., 2017; Kendler, Prescott, Myers & Neale, 2003; Kotov et al., 2017; Lahey et al., 2017; Nelson et al., 2015; Muetzel et al., 2017; Shanmugan et al., 2016; Snyder et al., 2017; Vollebergh et al., 2001; Waszczuk et al., 2014). Also, limited ability of the DSM to conceptualize comorbidity resulted in clinical trials being performed in patients who have little comorbidity (e.g., Zimmerman et al., 2002), although comorbidity is the norm and may affect treatment profile (e.g., Newman et al., 1998). Recent efforts to change this

have seen more generalizable trials for psychotherapy (Franco et al., 2016), but many studies remain focused on unrepresentative cases (Lorenzo-Luaces, Zimmerman & Cuijpers, 2018) especially pharmacotherapy trials (Franco et al., 2016). Moreover, arguments have been made that traditional diagnoses impede development and dissemination of psychotherapy (Hofmann & Hayes, 2018).

(ii) Treatment decisions are categorical (e.g. one either hospitalizes or not; cf. Kraemer, Noda & O'Hara, 2004) and a dichotomous diagnosis is aligned with this clinical need. However, clinical decision making occurs within a complex and nuanced frame and often cannot be reduced to a single dichotomy, as choices need to be made about degree of care, provider and treatment modality (Verhuel, 2005). DSM diagnosis built-in cutoffs may be less able to adapt to this multi-layered and multi-sequenced clinical decision-making. HiTOP approach enables specification of multiple ranges on a dimension of interest based on direct evidence, and so is more explicit about the need for this flexibility. Importantly, recent surveys with improved methodology show that clinicians find dimensional diagnoses may better help formulate treatment plans (Hansen et al. in press; Glover et al., 2012; Morey, Skodol, & Oldham, 2014).

(iii) DSM and ICD codes are likely to remain the language of administrative systems for years to come. HiTOP profile can be translated into these codes and we have developed a cross-walk for converting profile

to codes (provide url; also see below “Barriers” on how this can be addressed).

At this point, there is consistent but modest evidence that decision making of community clinicians aligns better with quantitative diagnoses compared to traditional diagnoses and clinicians may find the former to be more useful clinically. Also, HiTOPs combination of traits with symptoms, as opposed to separate diagnostic categories, can lead to reconceptualization of psychopathology that recognizes their frequent interdependence and relevance for one another (Goldstein et al., 2018), and make traits a more focal point of treatment. Finally, new treatments may better track the structure of HiTOP given its empirical derivation. For example, HiTOP may better map onto adaptive systems (c.f. Harkness et al., 2013), making it possible that it also better maps onto treatment mechanisms related to them.

However, there is no direct evidence that implementation of HiTOP diagnoses in clinical setting will improve treatment outcomes. We hypothesize that HiTOP will be a better guide for practitioners to select optimal treatment, as it provides richer and more precise description of patients, but we need studies that randomize patients to HiTOP diagnosis vs. assessment as usual to test this possibility directly.

Also, initial examples of novel treatments that were developed for dimensions included in HiTOP and found to be efficacious (e.g., Barlow et al., 2017; Norton, 2012) are encouraging. However, many more treatments need

to be designed for different elements of HiTOP, including other spectra, and evaluated in randomized clinical trials before it will be clear whether HiTOP can provide effective guidance to treatment development.

In addition to these three potential advantages and limitations for clinical utility, HiTOP also promises to accelerate basic clinical and psychotherapy research (Conway et al., 2019; Waszczuk et al., 2018). The heterogeneity of *DSM-5* disorders weakens and obscures the impact of any given treatment for a condition. With HiTOP, clinical interventions can be evaluated with respect to their specificity, and rather than simply concluding that a treatment is effective for a certain condition or not, one can discern the extent to which it is effective at different levels of the HiTOP hierarchy.

Moreover, HiTOP may better connect with other efforts to advance characterization of psychopathology. For example, Harkness and colleagues (2013) have advocated for functional theories that connect psychopathology to evolved adaptive systems as opposed to atheoretical descriptions that lack generative potential for mental health research. HiTOP's detailed, empirically-derived structure may better scaffold this research. Hofmann and Hayes (2018) advocate for process-oriented treatments that target specific processes that maintain psychopathology. They described how efficacy of these treatments is moderated by relevant patient characteristics – dimensions that HiTOP seeks to catalogue. The Research Domain Criteria (RDoC) framework has been criticized for lacking clinical applicability (Patrick

& Hajcak, 2016), and HiTOP offers clinical dimensions that can be linked to RDoC.

Box 1. Case illustration

Differences between categorical and HiTOP conceptualizations are highlighted through a hypothetical case of a 27-year-old woman referred to an outpatient practice by a family member concerned about her increasing social isolation. Comparisons focus on the more narrow aspects relevant to the *diagnostic nosology* being used.

Clinical Symptom Presentation

The client presented as guarded, with constricted affect, initially providing only cursory answers. In time, she settled into a conversational tone and maintained appropriate eye contact. She reported experiencing depressed mood most of each day over the last several months. Despite sleeping “all the time” she felt constant fatigue that had her wondering if “a permanent sleep” might bring relief. She had lost interest in activities, was eating less than usual and was attending few social functions. She described having had close friendships, but said she had “burned” many of them, in part because she said she “uses” her friends to get what she wants. She lived alone and was not dating anyone, although she had had brief, chaotic relationships with men in the past. She described excitement (i.e., “on top of the world”) and “getting carried away” at the start of these relationships, but said they often became volatile. Some began after excessive drinking, and most ended poorly. She persisted with attending family functions, where she described feeling evaluated and judged for “looking depressed.” These feelings would prompt anxiety and a desire to flee, upon which she did not

act. She noted she would sweat, tremble, and become short of breath and dizzy at the peak of her anxiety. Although this passed within minutes, she was left with a lingering fear that she may be "going crazy." Even before her recent symptoms, she recalled years of feeling worthless in the eyes of others. She reported once being sexually abused during adolescence but was reluctant to elaborate. She did, however, describe being upset when reminded of it, and said she avoids the neighborhood where it occurred.

Categorical nosology approach

Traditionally, a clinician might start with an interview to assess symptoms and psychosocial history more thoroughly, conduct a suicide-risk assessment, and determine the need to rule out symptoms due to a medical condition (e.g. hypothyroidism) or active substance use. A clinician would likely conceptualize the presenting problems from various theoretical orientations or known risk factors. But at the *point of diagnosis*, or even conceptualization of the presenting symptom profile, the clinician might often entertain a more specific series of alternative (differential) diagnoses if they are relying on traditional nosology. In our hypothetical case, this would include criteria related to at least six classes of disorders from the *DSM-5*: Depressive Disorders, Anxiety Disorders, Bipolar and Related Disorders, Trauma- and Stressor-Related Disorders, Substance-Related and Addictive Disorders, and Cluster B and C Personality Disorders. In all, these six classes contain 40 possible diagnoses, and 88 potential modifiers.

Careful differential review of respective sets of diagnostic criteria takes time. If time is short or the setting is an acute one (e.g. emergency department), diagnoses may be considered provisional (i.e., to be refined over the course of treatment), or may focus only on the most prominent

condition, comparing the case to prototypes (Martinez et al., 2008), for example.

With more time, the clinician can review symptoms more carefully to reach a diagnosis. In our hypothetical case, the clinician takes the time to assess relevant criteria and settles on six traditional diagnoses, remaining provisional with respect to a personality disorder: F32.1 Major Depressive Disorder, single episode, Moderate; F43.10 Post-Traumatic Stress Disorder, F40.10 Social Anxiety Disorder, and F41.0 Panic Disorder; provisionally, F60.0 Borderline Personality Disorder, F60.6 Avoidant Personality Disorder.

The clinician would discuss these initial formulations and diagnoses with the patient and review treatment options. Each of the six diagnoses has evidence-based therapies, and there is no clear direction for prioritization, so the clinician may decide to sequence treatment, or to apply a transdiagnostic one. It is important to realize that there is nothing in these traditional nosologies per se to suggest one approach or the other. To the degree the clinician believes that the diagnoses are valid representations of *different* diseases, this might suggest each disorder requires its own treatment, although it does not require it either. Supposing that the patient expressed a preference for psychotherapy above medications, the clinician might begin with cognitive behavior therapy (CBT) for depression, followed by CBT for social anxiety and prolonged exposure therapy for PTSD, reserving the possibility of Dialectical Behavior Therapy (DBT) for the provisional borderline personality disorder diagnosis. To the degree that indicators of avoidant personality disorder do not resolve after treating the social anxiety disorder, it would require another treatment if a sequenced approach based on diagnosis was followed. Finally, a clinician would

coordinate care with other health professionals, and provide for ongoing monitoring (Gelenberg et al., 2010).

HiTOP approach

How would clinical assessment and decision-making differ with a HiTOP approach? As before, a clinician would conduct a diagnostic interview, including a suicide-risk assessment, and rule out symptoms due to a medical condition or active substance use. As before, the assessment can occur within the larger context of a theoretical orientation or evidence-based approach (e.g., Hunsley & Mash, 2007). However, with HiTOP the client's presenting symptoms are understood from a fundamentally different diagnostic perspective. The clinician does not screen for diagnostic rule-outs related to the fit of presenting symptoms to a specific diagnostic category. Rather, presenting symptoms are conceptualized as related to one another, with varying degrees of specificity, in a hierarchical scheme.

A clinician could begin by screening for problems within the six higher-level spectra. In acute settings (e.g. emergency department again) where time is limited, the assessment may not progress in detail past this level, with the clinician determining elevations for each spectra based on cardinal or prototypic symptoms, or by noting relevant lower-level symptom components (e.g., suicidality). As time permits, however, elevated spectra scores would prompt more nuanced assessment at lower levels of that branch of the hierarchy. In this way, the diagnostician can drill down further depending on the level of detail they wish to achieve. They would also rate psychosocial impairment globally, regardless of symptoms.

In our hypothetical case, the clinician is in a setting with time for detailed assessment. They may initially opt to screen the six spectra and

psychological functioning with a questionnaire or brief interview. Using self-report measures would allow the clinician to contrast presenting symptoms to population-based norms. For example, the first step could be to routinely administer the Personality Inventory for *DSM-5* – Brief Form (PID-5-BF; Krueger et al., 2012), a 25-item measure of pathological traits that broadly surveys from several of the HiTOP spectra. It can be used to provide a quick overview of elevated internalizing problems (Negative Affectivity) and antagonistic externalizing problems (Antagonism), and confirm absence of elevations on other spectra (e.g. thought disorder, as indexed by the PID-5-BF Psychoticism scale). The clinician would also rate the degree of global impairment through an interview or questionnaire (e.g., Disability Assessment Schedule; WHO, 2000).

Based on initial screening and interviews, the clinician could then flesh out a more specific and nuanced profile of the lower-level dimensions. More targeted measures or scales can be administered since these allow client scores to be more easily contrasted with community-based norms (e.g., for the case above, the Inventory of Depression and Anxiety Symptoms [IDAS-II; Watson et al., 2012] measures specific subdimensions of internalizing symptomatology; the brief form of the Externalizing Spectrum Inventory [ESI-BF; Patrick, Kramer, Krueger, & Markon, 2013] has antagonism-related symptom subscales; PID-5 has additional scales related to Negative Affect and Antagonism). For the hypothetical case, administering these instruments would likely reveal elevations on subscales related to dysphoria, appetite loss, suicidality, insomnia, panic, social anxiety, traumatic intrusions and traumatic avoidance, as well as elevated traits of emotional lability, alienation, and manipulativeness.

On the assessment report, the clinician would profile the six spectra, indicating which are elevated and providing percentile scores based on normative comparisons when available. Within each spectrum, the clinician would note elevations on lower-order symptom and trait dimensions, also referenced to established norms when available. For example, our hypothetical case would report “Internalizing Spectrum, Severe,” followed by specific lower order symptoms and traits, with norm-based percentiles provided for each (as available). Table 1 briefly contrasts what diagnoses based on the *DSM-5* versus HiTOP would look like, and Figure 2 illustrates what a HiTOP profile could look like (i.e., spectra are on the left and more narrow components follow).

The shift in classification carries over to treatment planning. Rather than distinct diagnostic categories, a clinician would conceptualize two broad domains for treatment (i.e. internalizing and antagonistic externalizing in the example), with lower-order symptoms and traits characterizing nuances within each. With respect to treatment planning, the clinician has flexibility to target narrow symptoms or broader spectra depending on tools at his or her disposal, patient preferences (in this case, preference for psychotherapy). HiTOP’s structure naturally suggests the use of transdiagnsotic approaches, given that all of the internalizing symptoms, for example, cluster together. In our illustrative case, the clinician decides to use a broad approach for the internalizing symptoms (i.e., transdiagnostic Unified Protocol discussed earlier; Barlow et al., 2017), but a narrow intervention for antagonistic externalizing symptoms (i.e., techniques from interpersonal therapy to target trait manipulativeness).

The HiTOP approach to treatment planning in this illustrative case has at least four benefits. First, comorbidity no longer raises questions over the valid distinction between disorders, but becomes part of the conceptualization. In the illustration, rather than multiple distinct disorders, specific symptoms and traits are conceptualized as part of an internalizing spectrum. Clinicians who use a single therapy for multiple disorders may already be conceptualizing disorders this way. Second, HiTOP resolves the issue of heterogeneity, enabling clinicians to target narrow dimensions if they choose. For example, rather than focus on a heterogeneous category such as borderline personality disorder, a clinician can target specific symptoms or traits (e.g., target trait manipulativeness in the illustrative case). The ability to flexibly determine the level at which to intervene becomes a feature of the classification. Third, HiTOP explicitly incorporates subthreshold symptoms into its nosology, rather than relying on a single cutoff for diagnosis. In our hypothetical case, for example, clinicians could monitor appetite loss as part of the overall treatment plan, and address this if weight loss becomes significant. Fourth, traits from the HiTOP system offer prognostic information to assist planning (Bagby, Gralnick, Al-Dajani, Uliaszek, 2016) – for example, highlighting the degree to which antagonistic externalizing traits may affect the therapeutic alliance (Hirsh, Quilty, Bagby & McMain, 2012).

Barriers to the integration of HiTOP into practice

Despite its promise and advantages, integration of a diagnostic model like HiTOP into clinical practice faces significant barriers and concerns. We address eight prominent questions raised by these concerns here.

Is HiTOP-consistent classification harder to communicate to patients and providers? HiTOP communicates clinical problems based on psychopathological profiles rather than categorical diagnoses. Explaining the meaning of higher-level profiles can be more parsimonious than listing multiple, comorbid diagnoses. In turn, lower levels are analogous to communicating about symptoms. The hierarchical structure accommodates clinical complexity but also provides a flexible model for conceptualization and communication. The use of profiles, however, may initially present as more complicated for clinicians who are not accustomed to them. We believe familiarity can resolve this over time. Although not directly relevant, clinicians find dimensional models of personality acceptable or even preferred for communicating (Hansen et al. in press; Glover et al., 2012; Morey, Skodol, & Oldham, 2014), suggesting HiTOP's effects on communication can be overcome as barrier to integration.

Are there measures for assessing psychopathology with HiTOP? Many measures consistent with HiTOP nosology are already widely available and used in clinical practice (e.g., Achenbach et al., 2017; Clark, Simms, Wu, & Casillas, 2014; Krueger, et al., 2012; Morey, 2007a). For example, the Achenbach System of Empirically Based Assessment (ASEBA) originated in the 1960's in work with children and revealed dimensional syndromes organized into the higher-order groupings of Internalizing, Externalizing, Severe and Diffuse Psychopathology (Achenbach et al., 2017). Based on subsequent work over 50 years, ASEBA now has measures with norms that cover the lifespan (Achenbach et al., 2017). A HiTOP website (https://psychology.unt.edu/hitop) provides examples of other measures consistent with HiTOP.

However, no single measures listed on our website fully capture the HiTOP model. Several can be combined to cover most of it, and the consortium is piloting versions of these batteries (available upon request). The consortium is also in the middle stages of rigorously developing a free, omnibus HiTOP instrument, which is being developed and tested at multiple sites with diverse samples.

Will HiTOP-based assessment take too long or not be feasible? The hierarchical nature of HiTOP allows clinicians to take a stepwise approach, starting at higher levels and cascading downward as time permits and need requires. Much like a classic "review of systems" performed in general medicine (cf. Harkness et al., 2013), such a stepwise approach facilitates comprehensive evaluation at higher levels, which can be more efficient than review of criteria for multiple categorical disorders.

Moreover, many components can be assessed by self-report measures described earlier, which can be administered and scored simply and efficiently (although interviews are also available for many domains, if preferred). Multi-modal assessments remain preferred (e.g., McCrae, 2013) but skepticism about use of self-report (e.g., Huprich et al., 2011; Westen, 1997) may be overstated (Samuel et al., 2013; Samuel, Suzuki & Griffin, 2016). In short, HiTOP's reliance on reliable, validated self-report instruments can mitigate the issue of feasibility by reducing provider burden without necessarily compromising validity.

Nevertheless, adoption of a fully dimensional system will face the burdens of administering and scoring dimensional measures. To overcome this barrier, integrating assessment instruments with newer technologies is a critical next step. Computerized adaptive testing, and administration via

internet portals or smartphone applications, can reduce burden and increase the clinical utility of dimensional systems. Such second-generation advances exist for several instruments congruent with HiTOP, but more work is needed to make these fully available and easily integrated into practice.

Are there validated "cutoffs" for use in determining the need for treatment? With only a few exceptions, empirically-determined cutoffs for determining who needs treatment remain rare for HiTOP as well as for *DSM-5* or *ICD-10*. Several diagnoses based on cutoffs for the current categorical system (i.e., *DSM/ICD*) have been shown to have problems with reliability in formal field studies (Carragher et al., 2014) and cutoffs have been criticized on psychometric grounds (Finn, 1982). This serves as a compelling impetus for HiTOP: Using a hierarchical and dimensional system of measurement allows one to fine-tune assessments based on research in the field, and move away from a "one size fits all" cutoff inherent to dichotomous diagnoses. Classic perspectives on assessment strongly emphasize that test validity is *relative* to designated purposes, and dimensional approaches allow 'cutoffs' to be customized for particular assessment objectives. Though this will take time, we believe that the resulting ranges and cutoffs may be clinically meaningful, show increased sensitivity, and may fit more naturally into "stepped-care" models (cf. van Straten et al., 2015).

Can HiTOP be used in conjunction with DSM/ICD-based assessment protocols? Some HiTOP principles can be integrated with *DSM/ICD*-based assessments. *DSM-5* began taking steps toward HiTOP-consistent nosology by grouping similar syndromes into diagnostic classes, such as the autism and schizophrenia spectra, and the *DSM-5* alternative model for personality disorder is a trait-based diagnostic system. Many other *DSM-5* disorders

could be regrouped into classes consistent with HiTOP spectra, and conceptualized as part of a hierarchy (e.g. grouping depressive with generalized anxiety disorder as part of a distress subfactor). Disorder criteria can also be scored continuously as symptom counts and used as severity indicators, as is done now for *DSM-5* substance use disorders. Doing so provides some benefit over categories, although resulting scales would not map precisely onto HiTOP's dimensions. Such modifications would not be equivalent to a HiTOP approach, but nonetheless demonstrate how clinicians could begin to integrate HiTOP's underlying principles into case conceptualization without changing their assessment protocols.

Is HiTOP appropriate for youth? A number of studies have supported components of a hierarchical model in youth (Achenbach et al., 2017; Laceulle, Vollebergh, & Ormel, 2015; Lahey et al., 2011) and assessment tools exist for diverse ages. ASEBA, for example, has instruments specifically for children. Other instruments consistent with HiTOP have adolescent versions (e.g., Butcher et al., 1992; Linde, Stringer, Simms, & Clark, 2013; Morey, 2007b). Hence, HiTOP-consistent approaches to classification can be integrated into the assessment and treatment of youth.

How can a clinician using HiTOP be reimbursed? Reimbursement is often tied to ICD codes (i.e., an ICD diagnostic code must be submitted for an encounter in order for the clinician to get paid). Every diagnostic grouping in ICD includes an "unspecified" category for cases that do not meet the diagnostic criteria for a specific disorder within that grouping or for patients for whom the clinician chooses not to provide a specific code. Thus, the appropriate "unspecified" categories that correspond to the patients presenting symptoms could be used to meet administrative requirements.

The HiTOP Clinical Translation Workgroup has developed a free HiTOP-ICD crosswalk (URL: ADD) to allow clinicians to use HiTOP in their practice by linking HiTOP domains to ICD codes for billing and administrative purposes (e.g., the illustrative case described with the profile in Figure 2 could be given ICD codes F39, F41.9, F51.9, F60.9). This approach has limitations, but can provide a solution until billing and administrative procedures are better aligned with quantitative nosology.

8. How can HiTOP be incorporated into training? With time, we anticipate the possibility that diagnostic manuals may transition to a dimensional approach along the lines of HiTOP. For example, ICD recently adopted a more dimensional perspective for personality. However, until that time, courses in psychopathology will continue to be organized around categorical *DSM*/ *ICD* models, which creates training challenges. We suggest a transition with respect to training that mirrors the transition in clinical practice. The HiTOP model incorporates *DSM*-like constructs, breaking them down into smaller (symptom component) and larger (spectra) units in a hierarchical fashion. In our experience, this mapping is intuitive, making it straightforward to teach students the *DSM* categories for practical and perhaps temporary purposes, while familiarizing them as well with evidence-based hierarchical models. The connection between dimensional and categorical diagnosis is also intuitive. As discussed earlier, it is common for students to learn how to apply cut scores along recognized continua, such as blood pressure or IQ. Thus, students can be taught to think about diagnostic

cut scores for psychopathology diagnosis in the same way: diagnostic thresholds are indicators not of people who can be classified as qualitatively different from the healthy, but of relative severity on continua that suggest varying need for treatment.

Conclusions

Features of an alternative classification system based on quantitative methods are becoming increasingly clear and offer advantages over traditional nosology. The hierarchical-dimensional classification approach described here – the HiTOP system – is characterized by six overarching spectra of mental illness, each encompassing more narrowly defined and more homogenous elements, consisting of narrower symptom components and traits. Our aims in this article have been to describe major principles for integrating HiTOP into clinical practice, introduce tools that can assist clinicians, and illustrate what such an integration might look like. HiTOP has several advantages over traditional nosology that may improve its clinical utility, and clinicians may already be practicing with several of its principles in mind. However, the system shares some limitations of traditional nosology and may introduce new ones, so more work is needed to prove its utility for improving patient care.

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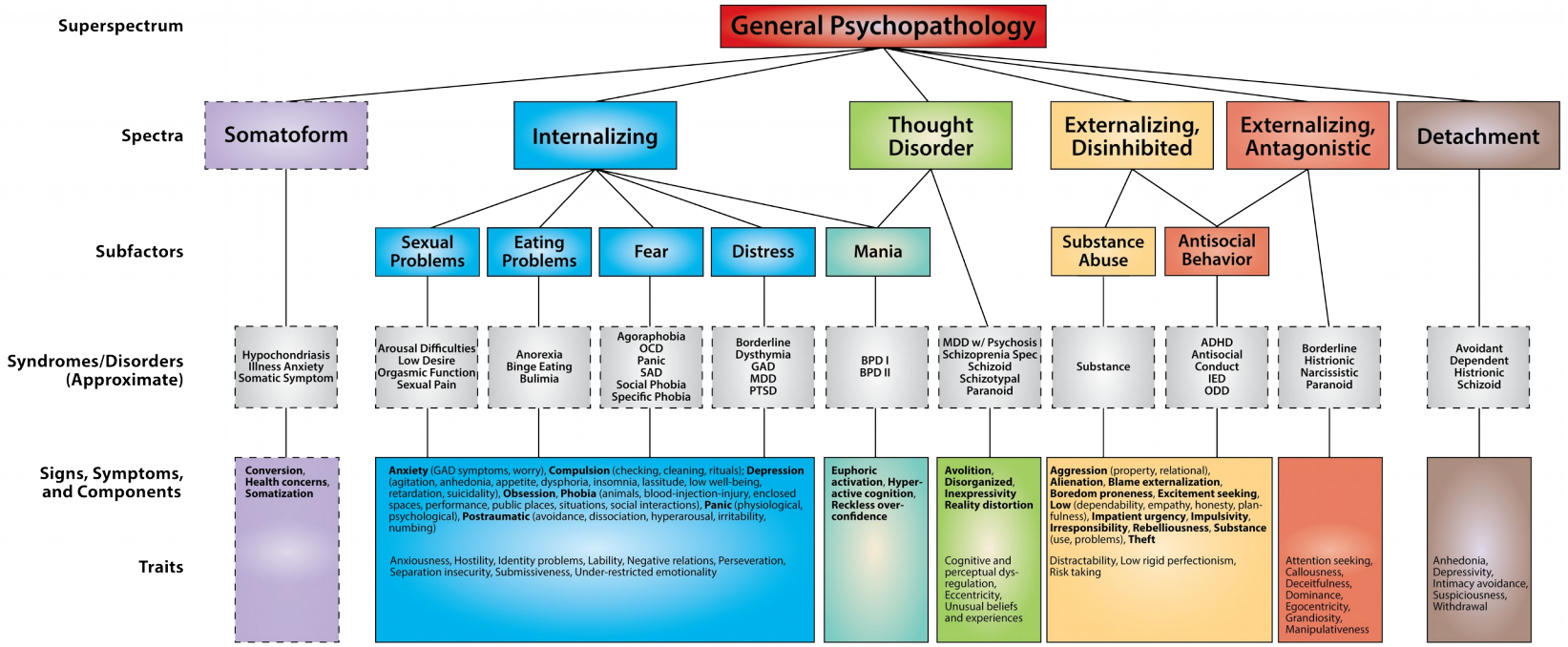
Table 1. *Illustrative Diagnoses for DSM-5 versus HiTOP*

DSM-5	*HiTOP*
Major Depressive Disorder, single episode, Moderate Post-Traumatic Stress Disorder Social Anxiety Disorder Panic Disorder Borderline Personality Disorder Avoidant Personality Disorder.	Internalizing, Severe (98%) *Prominent symptoms: dysphoria, appetite loss, suicidality, insomnia, panic, social anxiety, traumatic intrusions and avoidance; emotional lability* Antagonistic Externalizing, Mild (92%) *Prominent traits: manipulativeness*

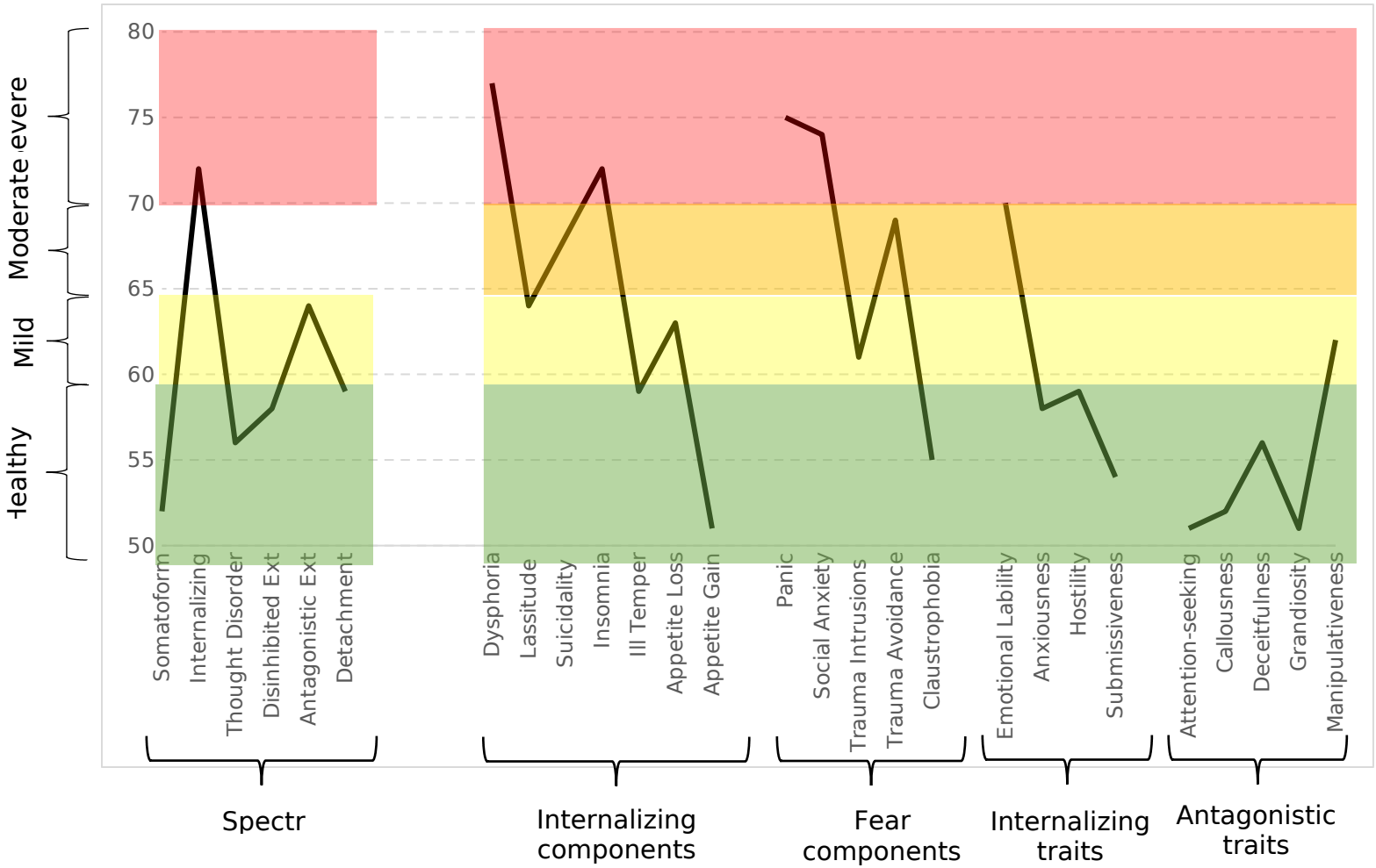
Note. Percentiles reflect scores relative to normative distribution and would come from test scores when available.

Figure 1. Hierarchical Taxonomy of Psychopathology model



Note: Dashed lines indicate elements of the model that are included on provisional basis. The level "Syndromes/Disorders" is included to indicate the approximate level of in the hierarchy most closely corresponding to current disorders; however, precise syndromes remain to be established in the model.

Figure 2. HiTOP profiles for the illustrative case



Note: Y-axis is T-score, which has mean of 50 and standard deviation of 10 in the general population. Scores presented here are for the fictional case presented, and would come from results of administered tests and administered scales (e.g., somatoform, thought disorder, disinhibited externalizing, and detachment subdimensions are not included in this illustrative case). Below average (T<50) range is not shown here, because in this example no scales fell into that range.